

INTERNATIONAL SEARCH REPORT

International Application No
PCT/JP2004/011007

A. CLASSIFICATION OF SUBJECT MATTER IPC 7 H01M4/02 H01M4/62 H01M10/40 H01M4/02 H01M10/40										
According to International Patent Classification (IPC) or to both national classification and IPC										
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) IPC 7 H01M										
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched										
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX, CHEM ABS Data										
C. DOCUMENTS CONSIDERED TO BE RELEVANT <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; padding: 2px;">Category *</th> <th style="text-align: left; padding: 2px;">Citation of document, with indication, where appropriate, of the relevant passages</th> <th style="text-align: left; padding: 2px;">Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;">X</td> <td style="padding: 2px;"> EP 1 191 131 A (SHOWA DENKO KABUSHIKI KAISHA) 27 March 2002 (2002-03-27) page 2, paragraph 5 – paragraph 8 page 3, paragraph 23 page 5, paragraph 28 – paragraph 35 page 8, paragraph 72 – paragraph 74 page 11, paragraph 110 – page 12, paragraph 112; example 8; tables 3,4 -/-- </td> <td style="text-align: center; padding: 2px;">1-10,12, 30-37,39</td> </tr> </tbody> </table>					Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	EP 1 191 131 A (SHOWA DENKO KABUSHIKI KAISHA) 27 March 2002 (2002-03-27) page 2, paragraph 5 – paragraph 8 page 3, paragraph 23 page 5, paragraph 28 – paragraph 35 page 8, paragraph 72 – paragraph 74 page 11, paragraph 110 – page 12, paragraph 112; example 8; tables 3,4 -/--	1-10,12, 30-37,39
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.								
X	EP 1 191 131 A (SHOWA DENKO KABUSHIKI KAISHA) 27 March 2002 (2002-03-27) page 2, paragraph 5 – paragraph 8 page 3, paragraph 23 page 5, paragraph 28 – paragraph 35 page 8, paragraph 72 – paragraph 74 page 11, paragraph 110 – page 12, paragraph 112; example 8; tables 3,4 -/--	1-10,12, 30-37,39								
<input checked="" type="checkbox"/> Further documents are listed in the continuation of box C. <input checked="" type="checkbox"/> Patent family members are listed in annex.										
* Special categories of cited documents : *A* document defining the general state of the art which is not considered to be of particular relevance *E* earlier document but published on or after the international filing date *L* document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) *O* document referring to an oral disclosure, use, exhibition or other means *P* document published prior to the international filing date but later than the priority date claimed										
Date of the actual completion of the international search 2 May 2005		Date of mailing of the international search report 10/05/2005								
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016		Authorized officer Gamez, A								

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 194 099 B1 (GERNOV YORDAN M ET AL) 27 February 2001 (2001-02-27) column 2, line 60 - column 3, line 15 column 4, line 43 - column 5, line 8 column 6, line 12 - line 29 column 7, line 11 - line 37 column 8, line 24 - line 43 column 10, line 66 - line 20 column 10, line 31 - line 41 examples 1-9	1-6,8,9, 28,30-39
X	FRYSZ C A ET AL: "Carbon filaments and carbon black as a conductive additive to the manganese dioxide cathode of a lithium electrolytic cell" JOURNAL OF POWER SOURCES, ELSEVIER SEQUOIA S.A. LAUSANNE, CH, vol. 58, no. 1, 1996, pages 41-54, XP004044538 ISSN: 0378-7753 page 41, right-hand column, paragraph 2 - page 42, left-hand column, paragraph 1 page 42, left-hand column, paragraph 4 - right-hand column, paragraph 1 page 44, left-hand column, paragraph 2 - paragraph 4 page 45, right-hand column, paragraph 3 page 46; table 1	1,2,5,6, 8,21,24, 30-39
X	PATENT ABSTRACTS OF JAPAN vol. 016, no. 441 (E-1264), 14 September 1992 (1992-09-14) -& JP 04 155776 A (MATSUSHITA ELECTRIC IND CO LTD), 28 May 1992 (1992-05-28) cited in the application abstract	1,2,5, 10,30-39
A	EP 0 858 119 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 12 August 1998 (1998-08-12) column 3, line 7 - line 32 column 4, line 38 - line 44 column 5, line 3 - line 9 column 9, line 30 - column 10, line 8; example 2	1-35
X	EP 0 858 119 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 12 August 1998 (1998-08-12) column 3, line 7 - line 32 column 4, line 38 - line 44 column 5, line 3 - line 9 column 9, line 30 - column 10, line 8; example 2	1,10, 30-39
A	EP 1 265 301 A (MITSUI MINING CO., LTD) 11 December 2002 (2002-12-11) page 9, paragraph 119	1-39
		-/-

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 437 943 A (FUJII ET AL) 1 August 1995 (1995-08-01) column 4, line 47 - line 62 column 6, line 44 - column 7, line 2 column 8, line 36 - line 62 column 11, line 51 - column 12, line 6	1-39
P, X	US 2004/043293 A1 (NAGATA MIKITO ET AL) 4 March 2004 (2004-03-04) page 2, paragraph 22 - paragraph 27	1,5-8, 18,30-39
A	page 2, paragraph 29 & EP 1 237 213 A (SANYO ELECTRIC CO., LTD) 4 September 2002 (2002-09-04) page 3, paragraph 10 - paragraph 12 page 4, paragraph 25 - page 5, paragraph 27 page 5, paragraph 32 page 6; table 1	1-39
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 11, 30 September 1999 (1999-09-30) & JP 11 149824 A (SHOWA DENKO KK), 2 June 1999 (1999-06-02) cited in the application abstract	1-39
A	PATENT ABSTRACTS OF JAPAN vol. 1999, no. 11, 30 September 1999 (1999-09-30) & JP 11 147989 A (SHOWA DENKO KK), 2 June 1999 (1999-06-02) cited in the application abstract	1-39

INTERNATIONAL SEARCH REPORT

Information on patent family members

 International Application No
PCT/JP2004/011007

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
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			EP	1265301 A2	11-12-2002
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			JP	6163047 A	10-06-1994
			JP	6132028 A	13-05-1994
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			EP	1237213 A2	04-09-2002
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			JP	11147989 A	02-06-1999
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			JP	2005056857 A	03-03-2005
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			US	6190805 B1	20-02-2001

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

05.5.09

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference see form PCT/ISA/220		FOR FURTHER ACTION See paragraph 2 below	
International application No. PCT/JP2004/011007	International filing date (day/month/year) 27.07.2004	Priority date (day/month/year) 28.07.2003	
International Patent Classification (IPC) or both national classification and IPC H01M4/02, H01M4/62, H01M10/40			
Applicant SHOWA DENKO K. K.			

1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- Box No. II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No. VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 a sequence listing
 table(s) related to the sequence listing
 - b. format of material:
 in written format
 in computer readable form
 - c. time of filing/furnishing:
 contained in the international application as filed.
 filed together with the international application in computer readable form.
 furnished subsequently to this Authority for the purposes of search.
3. In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or
industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-35,38,39
	No: Claims	36,37
Inventive step (IS)	Yes: Claims	
	No: Claims	1-39
Industrial applicability (IA)	Yes: Claims	1-39
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING
AUTHORITY (SEPARATE SHEET)**

Re Item V.

1 Reference is made to the following documents:

- D1: US-B1-6 194 099 (GERNOV YORDAN M ET AL) 27 February 2001 (2001-02-27)
- D2: US-A-5 437 943 (FUJII ET AL) 1 August 1995 (1995-08-01)
- D3: EP-A-1 265 301 (MITSUI MINING CO., LTD) 11 December 2002 (2002-12-11)
- D4: EP-A-1 191 131 (SHOWA DENKO KABUSHIKI KAISHA) 27 March 2002 (2002-03-27)
- D5: FRYSZ C A ET AL: "Carbon filaments and carbon black as a conductive additive to the manganese dioxide cathode of a lithium electrolytic cell" JOURNAL OF POWER SOURCES, ELSEVIER SEQUOIA S.A. LAUSANNE, CH, vol. 58, no. 1, 1996, pages 41-54, XP004044538 ISSN: 0378-7753
- D6: EP-A-0 858 119 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD) 12 August 1998 (1998-08-12)
- D7: PATENT ABSTRACTS OF JAPAN vol. 1999, no. 11, 30 September 1999 (1999-09-30) & JP 11 149824 A (SHOWA DENKO KK), 2 June 1999 (1999-06-02)

2 NOVELTY

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 36 is not new in the sense of Article 33(2) PCT.

Document D1 discloses (the references in parentheses applying to this document): a lithium battery having a high density electrode (col 2, I60-col3, I3 ; col 4, I43-I64) comprising an electroactive sulfur-containing cathode material and non-activated carbon nanofibers having a filament diameter less than 1000 nm (col 8, I24-I43). The electrolyte used can be a solid electrolyte polymer (col7, I21-I37). The specific capacities of the battery comprising(ex 1-10) are higher than 100 mAh/g.

3 INVENTIVITY

The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 1,34,35 does not involve an inventive step in the sense of Article 33(3) PCT.

The document D1 is regarded as being the closest prior art to the subject-matter of claim 1,34,35, and discloses (the references in parentheses applying to this document): a high density electrode comprising electroactive sulfur cathode material and non-activated carbon nanofibers (col 2, l60-col 3, l15). This electrode is used in a battery with a solid polymer electrolyte (col 7, l21-l24). The subject-matter of claim 1,35,35 therefore differs from this known D1 in that : the porosity of the high density electrode claimed is lower. In order to produce a high density electrode, the porosity is affected and reduced (D2 col 6, l44-l68, D3 p9, paragraph 119). The problem to be solved by the present invention may therefore be regarded as to produce a high density electrode with low porosity and improving the permeability and electrolytic solution retainability in the electrode.

The solution proposed in claim 1,34,35 of the present application cannot be considered as involving an inventive step (Article 33(3) PCT) for the following reasons. The addition of carbon fibre having a fibre filament of 1 to 1000 nm is known and is used not only to improve conductivity but also to improve the permeability of the electrolyte and then leading to the improvements of the characteristics of the battery (D1, col 6 l12-l29), D4, D5, D6, example2).

4. Dependent claims 2-33,37-39 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step, the reasons being as follows: the characteristics of the carbon fiber disclosed in the dependant claims is known from D4. The use of this carbon fiber in different types of active materials (graphite, metal oxide) has been shown for some of those active materials. It would be obvious to the person skilled in the art, namely when the same result is to be achieved to apply those feature with the corresponding effect to different types of active material when a high density electrode is needed.

The same reasoning applies to the specific type of polymers electrolytes already described

(D7).

Re Item VIII.

It is clear from the description on page 19 that the following features is essential to the definition of the invention:

- (1) the amount of the carbon fibre is 0.05 to 20 mass%.

Since independent claim 1 does not contain this feature it does not meet the requirement following from Article 6 PCT taken in combination with Rule 6.3(b) PCT that any independent claim must contain all the technical features essential to the definition of the invention.